REMARKS

The Office Action of June 14, 2011, has been carefully considered.

The objection to the drawings is obviated by amendment. Submitted herewith are replacement sheets for FIGS 1–6, which are believed to fully comply with the rules.

The objection to the specification is obviated by appropriate amendment. The priority data have been amended in accordance with the Examiner's helpful suggestions.

The rejection of claims 1–9 under 35 U.S.C. 101 as allegedly being directed to non-statutory subject matter is respectfully traversed.

It is submitted that claim 1, as amended, is directed to statutory subject matter. Favorable reconsideration of the rejection is thus urged.

The rejection of the claims under 35 USC 102(b) as being anticipated by Shimada et al. is respectfully traversed.

The Shimada et al. reference does not disclose each element of the claimed invention, as presently claimed, for the following reasons.

According to the present invention, the color effect of multilayer systems of the human skin is determined according to the Monte Carlo method. For this purpose are considered

dispersion coefficient, anisotropy factor, absorption coefficient, refractive index and dispersion phase function of the dispersing layer.

The disadvantages of the known methods are that the remission of the layer system cannot be measured sufficiently accurately, and that macroscopic optical parameters have to be determined with layer thicknesses which enable a transmission of light. Accordingly, prior art methods are sufficiently appropriate for use in the dental or dental technical field, since minimal color deviations between the dental prosthesis and natural teeth are noticeable and hence undesirable.

The object of the present invention is to more accurately than previously be able to calculate and thus predict the color perception for multilayer systems of combinations of various dispersive material, or biological substances consisting of combined, different layers with various optical properties for varying layer thicknesses, without having to repeatedly produce samples consisting of the combined layer thicknesses of interest, and to have to measure the color effect, e.g. in conventional color spectrophotometers, in each case.

In particular, the color perception for multilayer systems in the dental field should be calculated or predicted,

whereby series of layers in teeth, e.g. enamel and dentine, in any layer thickness desired and dental material, e.g. composites and ceramics, are of special interest.

For solving this objective, the present invention provides that:

"the intrinsic parameters dispersion coefficient μ_s, anisotropy factor g and absorption coefficient of each of the materials are first calculated on the basis of a layer thickness of material enabling transmission of light and that a corrected absorption coefficient μ_{ak} is then calculated by inverse Monte Carlo simulation on the basis of the remission of the respective material of an optically dense layer having a thickness d_D, the corrected absorption coefficient μ_{ak} as the absorption coefficient forming the basis for calculating the remission and the color effect of the multilayer system"

The invention provides a correction of the absorption coefficient by a two-stage method, the absorption coefficient being determined at layers enabling a transmission of light. This improves the accuracy of the determination of the remission and consequently the color effect of the multilayer system. Measured are, for instance, in a first measuring process in a spectrometer, the remission and transmission properties at a sample thickness being ideal for the subsequent inverse Monte Carlos simulation. The sample thickness is ideal when the collimated transmission T is in a defined range of values. Hence, layer thicknesses are to be taken as basis, which enable such a collimated transmission.

If the materials are extremely dispersive or in the event

of biological tissue, samples with very low layer thickness normally result. But the absorption coefficient cannot be determined precisely enough from those small layer thicknesses, since too less dispersion and absorption actions take place and the uncertainties in the determination of the absorption coefficient using inverse Monte Carlo simulation is correspondingly higher.

Therefore, for correcting the absorption coefficient, the invention provides, in a second stage, a further measurement (only remission properties) at an optical dense counter sample and the recalculation of the value determined firstly for the absorption coefficient by use of the measurements of the optical dense sample and the previously determined values of the dispersion coefficient and the anisotropy factor. The corrected absorption coefficient thus achieved is then taken as basis of the following Monte Carlo simulation for calculating the remission of the multilayer system. A sufficiently accurate determination of the color effect of the multilayer system is achieved only with this procedure.

According to the invention, the remission of the multilayer systems is determined sufficiently accurately in two stages by means of Monte Carlo simulations based on intrinsic optical parameters, each with different sample layer

thicknesses by means of a correction of the absorption coefficient.

Such a correction is not disclosed or suggested by Shimada et al. The inventive aspect of the present invention, i.e. using a corrected absorption coefficient based on the remission of the respective material of an optical thick layer with a thickness d_D, cannot be found in the state of the art.

In view of all of the above, it is submitted that the rejection under 35 U.S.C. 102(b) is unsustainable, and should be favorably reconsidered and withdrawn.

Applicant submits that the present application is now in condition for allowance. An early allowance of the application with amended claims is earnestly solicited.

Respectfully submitted,

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